NASA'S MISSION TO PLANET EARTH

EARTH PROBES

DATA INFORMATION SYSTEM
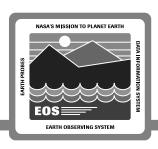
EOS

EARTH OBSERVING SYSTEM

Activity Constraints
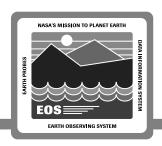
Steve Pawlish

24 August 1995

Constraints - Purpose

Determine Best Solution For Handling Constraints

- **Maximize Code Re-Use**

- **Simplify Interface For Users**

- **Gain Better Understanding of Constraint Types**
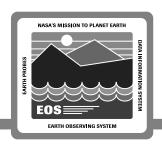
    - **Activity Level**

    - **Command Level**

Constraints - Overview

2 Types of Constraint Checking

- **Activity Level**
  - **Mode Transition Checks**
  - **SSR Buffer and Power Checks**
  - **Algorithmic Constraints (e.g. Field of View, Slew Rates)**
  - **User Specified Temporal Constraints**
- **Command Level**
  - **Rule-based Constraints**
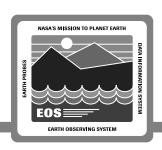 - **Commanding Limit Checks**

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Constraints - Overview

Differences Between Activity and Command Level Constraints

- **Activity Level**
    - **Dependent on Resources**
    - **Incomplete Plan**

        Interactive Constraint Checking

- **Command Level**
    - **Independent of Resources**
    - **Complete Plan**
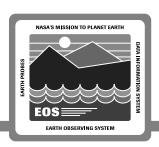
Activity Constraints - Approach

Study Possible Solutions for Activity Level Constraints

- **ILOG**
    - **Generic COTS Scheduling System**
- **PARR**
    - **Scheduler Currently Used In MOPSS Mission**
- **Customized Solution Using Delphi**
    - **COTS-Like Set of C++ Class Libraries**
    - **Partial Set Of Constraints Already Prototyped**

Compare Solutions with CMS

- **Wind/Polar**
- **PARR**
- **Customized Solution**

Activity Constraints - Results

ILOG Advantages

- **Provides Resource Modeling Capabilities**
- **Extensive Scheduling Engine for Optimization and Constraint Solving**

ILOG Disadvantages

- **Expensive Relative to Other Solutions**
- **Extensive Library Requires Training**
- **Difficult Integration with Delphi and Current Prototype**
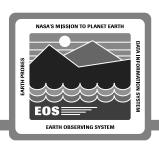- **Source Code Not Available**

Activity Constraints - Results

PARR Advantages

- **No License Fee**
- **Reuse Code from Other Goddard Projects**

PARR Disadvantages

- **Performs Schedule Creation**
  - **Just Need Constraint Checking**
- **No Easy Interface With Existing P&S Code**
  - **Lack of Resource Modeling**
  - **Requires Complete Knowledge of PARR Libraries**
  - **Requires Modification of Both PARR and P&S Code**
- **Difficult and Ambiguous Interface for Constructing Rules**
- **Numerous Constraints Unneeded in P&S Domain**
- **PARR Libraries Dependent on Third-Party Libraries**
- **Limited Support**

Activity Constraints - Results

Customized Solution Advantages

- **Implement Only a Subset of PARR Constraint Checks**
- **No Problems Integrating With Existing P&S Code**
- **Extensible To Handle New Constraints**
- **Uses Existing Prototype Code**
- **Relatively Little New Code Required**

Customized Solution Disadvantages

- **Less Reuse of Other COTS Products**
- **Currently No Capabilities Provided for Solving Constraints**